

University of Sargodha

ADP/BS 1st Semester Examination 2025

Subject: Mathematics

Paper: Element of Set Theory & Mathematical Logic/ Set Theory & Mathematical Logic
(MATH-5102/MATH-103/MATH-103I)

Time Allowed: 02:30 Hours

Maximum Marks: 60

Note: Objective part is compulsory. Attempt any three questions from subjective part.
(Illustrate your answer with diagram where needed).

Objective Part (Compulsory)

- Q.1. Write short answers of the following in 2-3 lines each on your answer sheet. (2*12)
- i. Define Cartesian product of sets A and B .
 - ii. Let $A = \{1, 2, 3\}$, $B = \{a, b, c\}$, $C = \{x, y, z\}$. Consider R from A to B and S from B to C be two relations define as $R = \{(1, b), (2, a), (2, c)\}$ and $S = \{(a, y), (b, x), (c, y), (c, z)\}$. Write composition relations $R \circ S$.
 - iii. Define cardinal number of finite sets.
 - iv. Why $R = \{(1,1), (1,2), (2,1), (2,2), (3,3), (4,4)\}$ is symmetric relation on $A = \{1, 2, 3, 4\}$?
 - v. State Cantor's theorem.
 - vi. Define countable set.
 - vii. Give the reason why $P = \{\{1, 3, 5\}, \{2, 4, 6, 8\}, \{5, 7, 9\}\}$ is not partition of $A = \{1, 2, 3, \dots, 9\}$?
 - viii. Define minimal element of the partially ordered set.
 - ix. Define well-ordered set.
 - x. State Zorn's Lemma.
 - xi. Draw the truth table for disjunction.
 - xii. Find the truth set T_p of propositional function $p(x)$ defined on the set $\{1, 2, 3, \dots\}$, where $p(x)$ is " $x + 1 > 9$ ".

Subjective Part (3*12)

- Q.2. Suppose A and B are finite disjoint sets. Then show that
 $A \cup B$ is finite and $n(A \cup B) = n(A) + n(B)$.
- Q.3. Given $A = \{1, 2, 3, 4\}$ and $B = \{x, y, z\}$. Let R be the relation from A to B defined as
 $R = \{(1, y), (1, z), (3, y), (4, x), (4, z)\}$.
Draw arrow diagram, determine matrix M_R of the relation and find R^{-1} .
- Q.4. Prove that every infinite set A contains a subset D which is denumerable.
- Q.5. Prove that the intervals $[0, 1]$, $(0, 1)$ and $[0, 1)$ have the same cardinality.
- Q.6. Prove that the following argument is valid: $p \rightarrow \sim q, r \rightarrow q, r \vdash \sim p$.

Note: Objective part is compulsory. Attempt any three questions from subjective part.

Objective Part (Compulsory)

- Q.1.** Write short answers of the following in 2-3 lines each on your answer sheet. (2*12)
- i. Define scalar triple product.
 - ii. Find scalar triple product of $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = \hat{i} - \hat{j} - \hat{k}$, $\vec{c} = 2\hat{i} - \hat{j} + 3\hat{k}$.
 - iii. Prove that if two vectors are parallel, then their scalar triple product is zero.
 - iv. Write the formula for $(\vec{a} \times \vec{b}) \times \vec{d}$.
 - v. Find vector triple product of $\vec{a} = 2\hat{i} + 3\hat{j} + 4\hat{k}$, $\vec{b} = 3\hat{i} - 2\hat{j} - \hat{k}$, $\vec{c} = \hat{i} + \hat{j} - 3\hat{k}$.
 - vi. Define a vector point function.
 - vii. Define a vector operator ∇ .
 - viii. Define divergence of a vector point function.
 - ix. Define coordinate surfaces in cylindrical polar coordinates.
 - x. Define a tensor of rank two.
 - xi. Define Kronecker delta.
 - xii. What is difference between orthogonal and orthonormal conditions?

Subjective Part (3*12)

- Q.2.** (a) Derive a formula for vector triple product.
 (b) Prove, for any vectors $\vec{a}$, $\vec{b}$, $\vec{c}$, $\vec{p}$, $\vec{q}$, $\vec{r}$, that

$$[\vec{a} \times \vec{p}, \vec{b} \times \vec{q}, \vec{c} \times \vec{r}] + [\vec{a} \times \vec{q}, \vec{b} \times \vec{r}, \vec{c} \times \vec{p}] + [\vec{a} \times \vec{r}, \vec{b} \times \vec{p}, \vec{c} \times \vec{q}] = 0$$
- Q.3.** (a) Solve the simultaneous equations $\vec{r} \times \vec{a} = \vec{a} \times \vec{b}$, $\vec{r} \cdot \vec{c} = 0$ (where $\vec{a}, \vec{c} \neq 0$).
 (b) Find the directional derivative of ϕ at P in the direction of vector $\vec{u}$ where
 $\phi = e^{2x-y+z}$, $P: (1, 1, 1)$, $\vec{u} = -3\hat{i} + 5\hat{j} + 6\hat{k}$
- Q.4.** (a) Show that $[\nabla(f(r))] \times \vec{r} = 0$.
 (b) Evaluate $\nabla \cdot [r \nabla(r^{-3})]$.
- Q.5.** (a) Derive relations for divergence and curl of a vector point function in curvilinear coordinates system.
 (b) Find transformation equations for unit vectors in cylindrical coordinates system.
- Q.6.** (a) Define Kronecker delta and Alternating Symbol. Also derive the relation

$$\epsilon_{ijk} \epsilon_{lmk} = \delta_{il} \delta_{jm} - \delta_{im} \delta_{jl}$$

 (b) Prove that the Laplacian operator $\nabla^2 = \frac{\partial}{\partial x_i} \frac{\partial}{\partial x_i}$ is invariant under a rotation of axes.

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ADP/BS 1st Semester Examination 2025

Subject: Physics/Mathematics

Paper: Calculus-I (MATH-5101)

Time Allowed: 02:30 Hours

Maximum Marks: 60

Note: Objective part is compulsory. Attempt any four questions from subjective part.

Objective Part (Compulsory)

Q.1. Write short answers of the following in 2-3 lines of each on your answer sheet. (2*12)

- i. Find the domain and range of the function $f(x) = \sqrt{x^2 - 3x}$.
- ii. Define derivative of a function.
- iii. State the Roll's theorem.
- iv. Find $\lim_{h \rightarrow 0} \frac{\sqrt{5h+4}-2}{h}$.
- v. How to find the critical points of a function?
- vi. Differentiate $y = xe^{-x} + e^{x^3}$.
- vii. If $\lim_{x \rightarrow 4} \frac{f(x)-5}{x-2} = 1$, then find $\lim_{x \rightarrow 4} f(x)$.
- viii. Find the open intervals on which the function $y = 2x^3 - 18x$ increasing or decreasing.
- ix. Find $\lim_{x \rightarrow \infty} \frac{e^x}{x^2}$.
- x. Find the average value of the function over the interval $y = x^2 - 1$, $[0, \sqrt{3}]$.
- xi. Find dy/dx if $y = x \int_2^{x^2} \sin(t^3) dt$.
- xii. Find dy/dx if $xy = \cot(xy)$.

Subjective Part (4*9)

- Q.2. Evaluate the integral $\int_2^4 x^{2x} (1 + \ln x) dx$.
- Q.3. Find $\lim_{x \rightarrow 0} \frac{x - x \cos x}{\sin^2 3x}$.
- Q.4. Evaluate $\int \frac{dt}{(t+1)\sqrt{t^2+2t-8}}$.
- Q.5. Discuss the curve $y = x^4 - 4x^3$ with respect to concavity, points of inflection, local maxima, and local minima.
- Q.6. Find area of the surface generated by revolving the curve $y = 2\sqrt{x}$, $1 \leq x \leq 2$ about the x-axis.
- Q.7. Evaluate by substitution $\int \frac{1}{\sqrt{xe^{-\sqrt{x}}}} \sec^2(e^{\sqrt{x}} + 1) dx$.

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ADP/BS 1st Semester Examination 2025

Paper: Functional English (URCG-5118)

Time Allowed: 02:30 Hours

(For all programs)

Maximum Marks: 60

Note: Objective part is compulsory. Attempt any three questions from subjective part.

Objective Part (Compulsory)

- Q.1. Write short answers of the following in 2-3 lines each on your answer sheet. (2*12)
- Define transitional devices. Give example.
 - Differentiate between topic sentence and concluding sentence.
 - What is a narrative essay? Give example.
 - Enlist the qualities of a good précis.
 - Define conciseness.
 - Enlist the ways of generating ideas.
 - Define thesis statement.
 - What is the role of pronouns in passive voice?
 - How can critical reasoning help us evaluate arguments?
 - Define affirmative sentence. Give example.
 - Change the voice of the following sentences: i) He cut the rope ii) We were playing chess.
 - Correct the following sentence: *It is raining fastly.*

Subjective Part

- Q.2. Define essay. Explain the different types of essays with examples. (12)
- Q.3. Define voice. Explain and exemplify the rules of Active and Passive Voice sentences according to tense. (12)
- Q.4. Write a compact and coherent paragraph on the *Importance of Science*. (12)
- Q.5. Write down a note on the different ways of developing ideas in writing. (12)

- Q.6. Read the following passage carefully and answer the questions given at the end.
- The history of literature really began long before man learned to write. Dancing was the earliest of arts. Man danced for joy round his primitive camp fire after the defeat and slaughter of his enemy. He yelled and shouted as he danced and gradually the yells and shouts became coherent and caught the measure of the dance and thus the first war song was sung. As the idea of God developed, prayers were framed. The songs and prayers became traditional and were repeated from one generation to another, each generation adding something of its own. As man slowly grew more civilized, he was compelled to invent some method of writing by three urgent necessities. There were certain things that it was dangerous to forget and which, therefore, had to be recorded. It was often necessary to communicate with persons who were some distance away and it was necessary to protect one's property by making tools, cattle and so on, in some distinctive manner. So man taught himself to write and having learned to write purely for utilitarian reasons he used this new method for preserving his war songs and his prayers. Of course, among these ancient peoples, there were only a very few individuals who learned to write, and only a few could read what was written.
- What was the earliest form of literature? (01)
 - How did the first war song begin? (01)
 - Why did man invent writing? (01)
 - Make a précis of the passage and also give it a suitable title. (09)

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ADP/BS 1st Semester Examination 2025

Paper: Applications of ICT (URCG-5123/URCI-5123)

Time Allowed: 02:30 Hours

Maximum Marks: 40

Note: Objective part is compulsory. Attempt any three questions from subjective part.

Objective Part (Compulsory)

Q.1. Write short answers of the following in 2-3 lines each on your answer sheet.

(2*8)

- i. Why IT is important?
- ii. Name three components of computer hardware.
- iii. Explain the role of storage devices in computing.
- iv. Define operating system with examples.
- v. Differentiate between system software and application software.
- vi. What is the significance of programming languages in computing?
- vii. What is a database?
- viii. How do internet browsers differ from search engines?

~~Dynamic~~
~~Static~~
~~System~~
~~Business~~

Subjective Part (3*8)

- Q.2. Discuss the importance of understanding the various types of computer software in today's technological landscape. Provide examples to illustrate your points.
- Q.3. Compare and contrast file processing systems with database management systems. Discuss the advantages and disadvantages of each approach.
- Q.4. Analyze the key issues related to IT security, including data breaches, cyberattacks, and privacy concerns. How can organizations mitigate these risks?
- Q.5. Analyze the impact of cyber laws on online behavior and digital transactions. How do these laws protect individuals and organizations in the digital age?
- Q.6. List and briefly explain different type of websites.

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ADP/BS 1st Semester Examination 2025

Paper: Islamic Studies (Compulsory) (URCG-5105)

Time Allowed: 02:30 Hours

(For all programs)

Maximum Marks: 60

Note: Objective part is compulsory. Attempt any three questions from subjective part.

Objective Part (Compulsory)

Q.1. Write short answers of the following in 2-3 lines each on your answer sheet. (2*12)

- Give a brief introduction to the Quran.
- Write down the characteristics of Madani Surahs.
- Describe three Prophetic manners, in the light of Surah Al-Hujurat.
- What is meant by the sciences of the Quran, and what are they?
- Write three important points of the Farewell Sermon.
- What is the difference between culture and civilization? Explain.
- Describe in four lines the role of Muslims in botany/agriculture.
- What is meant by the term "marfu' ar-mawquf" (abandoned hadith)?
- Write the names of two famous books of Muhammad bin Musa al-Khwarizmi.
- Explain the difference between Ghazwa and Saraya.
- Write a Quranic verse on the end of prophethood.
- Describe the conditions of the Treaty of Hudaibiyah.

سوال قرآن کا اجمالی تعارف بیان کریں۔ 2۔ مدنی سورتوں کی خصوصیات تحریر کیجیے۔ 3۔ سورہ الحجرات کی روشنی میں تین آداب نبوی بیان کیجیے۔ 4۔ علوم قرآن سے کیا مراد ہے؟ نیز کوئی سے بیان کیجیے؟ کتب خطبہ جیزہ الوداع کے تین اہم نکات تحریر کیجیے۔ 6۔ تہذیب و تمدن میں کیا فرق ہے؟ بیان کریں۔ 7۔ علم نباتات / زراعت میں مسلمانوں کا کردار چار سطروں میں بیان کریں۔ 8۔ حدیث مرفوعہ اور موقوفہ سے کیا مراد ہے؟ 9۔ محمد بن موسیٰ الخوارزمی کی دو مشہور تصانیف کے نام لکھیں۔ 10۔ غزوہ اور سرایہ میں فرق بیان کریں۔ 11۔ ختم نبوت پر ایک قرآنی آیت تحریر کیجیے۔ 12۔ صلح حدیبیہ کی شرائط بیان کیجیے۔

Subjective Part

Q.2. Translate the following verses. (6+6)

درج ذیل آیات کا ترجمہ کریں۔

الف: "وَالَّذِينَ إِذَا أَنْفَعُوا لَمْ يُنْفَعُوا وَلَمْ يَنْفَعُوا وَكَانَ بَيْنَ ذَلِكَ قَوَامًا"۔

ب: "لَا يَكْلِفُ اللَّهُ نَفْسًا إِلَّا وَمَنْعَهَا" لَهَا مَا كَسَبَتْ وَعَلَيْهَا مَا اكْتَسَبَتْ رَبَّنَا لَا تُؤَاخِذْنَا إِنْ لَيْسَ لَنَا بِإِثْمٍ وَلَا بِذَنْبٍ

Q.3. Translate the following blessed hadiths. (6+6)

درج ذیل احادیث مبارکہ کا ترجمہ کریں۔

الف: "وَعَنْ مَالِكِ بْنِ أَنَسٍ مُرْسَلًا قَالَ: قَالَ رَسُولُ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ: "تَزَكَّيْتُ فِيكُمْ أَمْزِنَ لَنْ تَضِلُّوا مَا تَمَسَّكْتُمْ بِهِمَا: كِتَابَ اللَّهِ وَمَنْعَةَ رَسُولِهِ"۔ رَوَاهُ فِي الْمَوْطَأِ"

ب: "عَنْ أَبِي هُرَيْرَةَ رَضِيَ اللَّهُ عَنْهُ عَنِ النَّبِيِّ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ قَالَ: اجْتَنِبُوا السَّبْعَ الْمُفَوِّقَاتِ: «الْفِرَاقَ وَالْبَيْعُورَ، وَفَقْدَ النَّفْسِ الَّتِي حَرَّمَ اللَّهُ إِلَّا بِالْحَقِّ، وَآكُلَ الرِّبَا، وَآكُلَ مَالِ الْيَتِيمِ، وَالتَّوَلَّى يَوْمَ الْزُّخْفِ، وَقَذْفَ الْمُخَضَّبَاتِ الْمُؤْمِنَاتِ الْغَافِلَاتِ"

Q.4. Write comprehensive notes on Sahih Sita. (12)

صحاح سیرت پر جامع نوٹ لکھیں۔

Q.5. Write down comprehensive notes on the Covenant of Medina and the Farewell Hajj Sermon. (12)

بیان مدینہ اور خطبہ جیزہ الوداع پر جامع نوٹ قلمبند کریں۔

Q.6. Record the description of the biography of the Holy Prophet (PBUH) in the Holy Quran. (12)

قرآن مجید میں سیرت سرور عالم ﷺ کا بیان قلمبند کیجیے۔